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ABSTRACT

Compared were the adaptive behavior and IQ scores of educable retarded persons 16- to 45-years-old who were successful (N=47) in group living. Scores of parts 1 and 2 of the Adaptive Behavior Scale, including domains of independent functioning, language development, antisocial behavior, and unacceptable or eccentric habits were correlated to house parents' determination of success or failure. Data indicated a significant difference between the two groups. Behavior domains linked to nonsuccessful group living included untrustworthy behavior, economic activity, and hyperactive tendencies. Results suggested the feasibility of insuring appropriate placement through behavior rating. (CL)

Department of Special Education

of the

University of Florida

Title: A COMPARISON OF THE ADAPTIVE BEHAVIOR OF RETARDED INDIVIDUALS SUCCESSFULLY AND UNSUCCESSFULLY PLACED IN GROUP LIVING HOMES

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A Comparison of the Adaptive Behavior of Retarded Individuals Successfully and Non Successfully Placed in Group Living Homes

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Introduction

Educators long have been interested in the return of the retarded individual to the community following a period of confinement in a residential facility. Fernald, in an address to the American Association for the Study of the Feebleminded in 1906 (Noone, 1968), may have given impetus to this when he indicated that he had placed some of the residents from an institution for the mentally retarded into the community and "surprisingly a considerable number were successful." From this initial recognition, interest and movement in this direction were gradual until the present. Currently many institutions throughout the country are making "deinstitutionalization" a top priority activity in program planning.

Recently added momentum was given to the notion of returning the retarded to the community. The President's Committee on Mental Retardation, MR: 71, indicated that one of the major, national goals is to return one third of the retarded now living in institutions to community living, and further, to make them useful citizens through training for productive employment. The committee indicated that this can be accomplished by using our present knowledge and techniques from the biomedical and behavioral sciences. This new thrust should give an added incentive to professionals in the field of mental retardation to work toward the development of a list of behavioral competences needed by the retarded individual for successful adaptation to the demands of community living.

In his analysis of articles in the literature on mental retardation, Tymchuk (1971) indicates that studies of a social nature dealing with retardation are desperately needed if the move toward public assimilation of the retarded is to be continued successfully. Tymchuk considers studies dealing with institutions and the community as falling into this category. Tarjan and associates (1973) state that "there is practically no information available concerning the adjustment of the retarded in the communities."

Statement of Problem

At present in the United States there is a rapid trend towards the establishment of group living homes for the retarded individual within various communities. In January of 1970 the first resident from Sunland Training Center in Gainesville, Florida was placed in a group living home. In January 1973, the first group living home opened for the mentally retarded in Georgia. These group living homes are generally operated by the local county Associations for Retarded Children.

With the rapidly changing attitude regarding residential facilities and personnel found there, along with the increased incentive toward community placement, care must be taken to minimize the possibility of error in the placement of these individuals into the community. Placement without fully understanding all of the requisite, concomitant behavior could have detrimental effects. The main questions addressed in the present investigation were: Would the knowledge of a retarded individual's adaptive behavior patterns aid in predicting his success in a group living home? And, would the behavioral patterns of those who failed in their community placement differ from those who succeeded there? Thus, the purpose of this study was to compare the adaptive behavior patterns of retarded individuals successfully and nonsuccessfully placed in group living homes so as to facilitate more accurate placement for such individuals.

The adaptive behavior patterns were determined by using the Adaptive Behavior Scale developed by the American Association on Mental Deficiency. Adaptive behavior represents the reversible dimension within the behavioral aspects of mental retardation. (Leland, 1965, 1968). Measurement of these reversible behaviors will provide the basis for curriculum development (Leland, et.al., 1968) and optimal community placement. An individual classified at a certain adaptive behavior level could be placed into an appropriate training program in order that an effort can be made to ameliorate areas of deficiency.

Procedures

In general this study compared the 24 areas of adaptive behavior measured by the AAMD Adaptive Behavior Scale and the I.Q. of those retarded individuals successfully and nonsuccessfully placed in group living homes. The data was gathered from December, 1972 through March, 1973.

Subjects

The subjects who participated in this study were those retarded individuals who had been placed from the Sunland Training Centers into Group Living Homes within the state of Florida. There were 72 subjects, 47 of whom had been classified as successful and 25 nonsuccessful. They ranged in age from 16 to 45 with an I.Q. range of 45 to 74. Fifty were male and twenty-two were female.

Source of Data

The Adaptive Behavior Scales are behavior rating scales for mentally retarded and emotionally maladjusted individuals. They are designed to provide an objective description and assessment of an individual's adaptive behavior (Nihira et.al. 1969). These scales, published in 1969, became commercially available in the early part of 1970 (Mental Retardation, 1970). This followed extensive research conducted by Leland, Nihira and associates at the Parsons State Hospital and Training Center beginning in 1963 (Heber, 1962).

As stated in the Manual of the Adaptive Behavior Scales, the instrument can serve many purposes of which one is "To identify the areas of deficiencies that individuals or groups have in order to facilitate accurate placement and proper assignment of curriculum or training programs (Greenwood and Perry, 1969)." By using this instrument, more accurate placement and more effective curriculum planning can take place.

The Scale consists of two parts.

Part I of the Adaptive Behavior Scale is designed to assess the individual's skills and habits in ten behavior domains considered important to the maintenance of personal independence in daily living. Part A is a comprehensive review of most of the behavior rating scales currently part of the public domain in both the United States and Great Britain (Leland, et.al., 1967). The ten behavior domains are:

I. Independent Functioning

II. Physical Development

III. Economic Activity

IV. Language Development

V. Number and Time Concept

VI. Occupation - Domestic

VII. Occupation - General

VIII. Self-Direction

IX. Responsibilities

X. Socialization

Part II is designed to provide measures of maladaptive behavior related to personality and behavior disorders. Part II consists of the following fourteen domains:

A. Violent and Destructive Behavior

B. Antisocial Behavior

C. Rebellious Behavior

D. Untrustworthy Behavior

E. Withdrawal

F. Stereotyped Behavior and Odd Mannerisms

G. Inappropriate Interpersonal Manners

H. Inappropriate Vocal Habits

I. Unacceptable or Eccentric Habits

J. Self-Abusive Behavior

K. Hyperactive Tendencies

L. Sexually Abberant Behavior

M. Psychological Disturbances

N. Use of Medications

Administration of the Instruments

The administration of the Adaptive Behavior Scale was conducted by personnel from the Sunland Training Center and by personnel from the various group living homes. Authorization and appointing of each individual was done by administrative personnel in the respective locations. The writer then visited with the group living home personnel and institutional personnel selected for inclusion in the study and instructed the designated personnel on the correct method of administering these instruments. The subject's intellectual level was taken from the individual's records at the Sunland Training Center. In all cases this had been determined by an individually administered intelligence test.

Determination of Success or Failure

The determination of success or failure of the individual was done by the house parents and other placement personnel. If an individual made a successful adaptation to the community by holding a job, getting along with his peers, etc., he was given an ABS rating by the house parents and other personnel at the group living home. If he had not made a successful adaptation, he was returned to the institution, thus being deemed a failure. He was then given the ABS rating by institutional personnel who were very familiar with the individual.

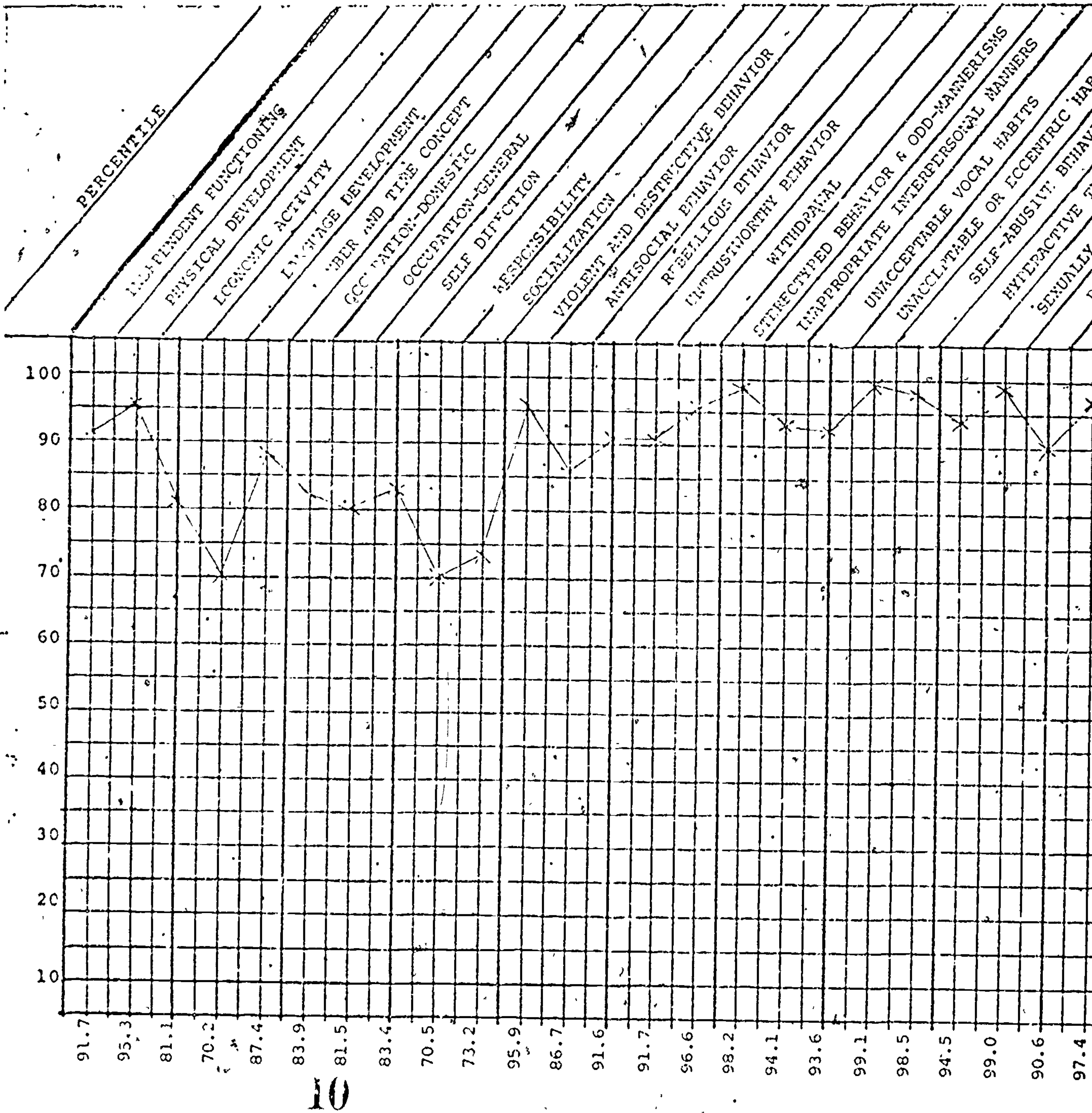
Analysis of Data

Multiple discriminant function analysis was used for the interpretation of this data. Discriminant function yields normalized vector weights which determine which of the 25 variables carry the most weight in determining success or failure. Another advantage to this approach is that it produces a hit-miss classification table which assigns individuals to either the successful or unsuccessful group. To test the hypothesis that the centroid values were the same in the two groups for the 25 variables a chi-square with 24 degrees of freedom at the level of .05 significance was used. The analysis yielded the value 109.5634 with the chi-square table listing 36.415 as the value. Thus the null hypothesis was rejected at the .05 level.

Figure I shows the mean and standard deviation of the 25 variables. The scoring was done on a percentile, therefore the closer the score is to 100 the less problem the individual is having in this area.

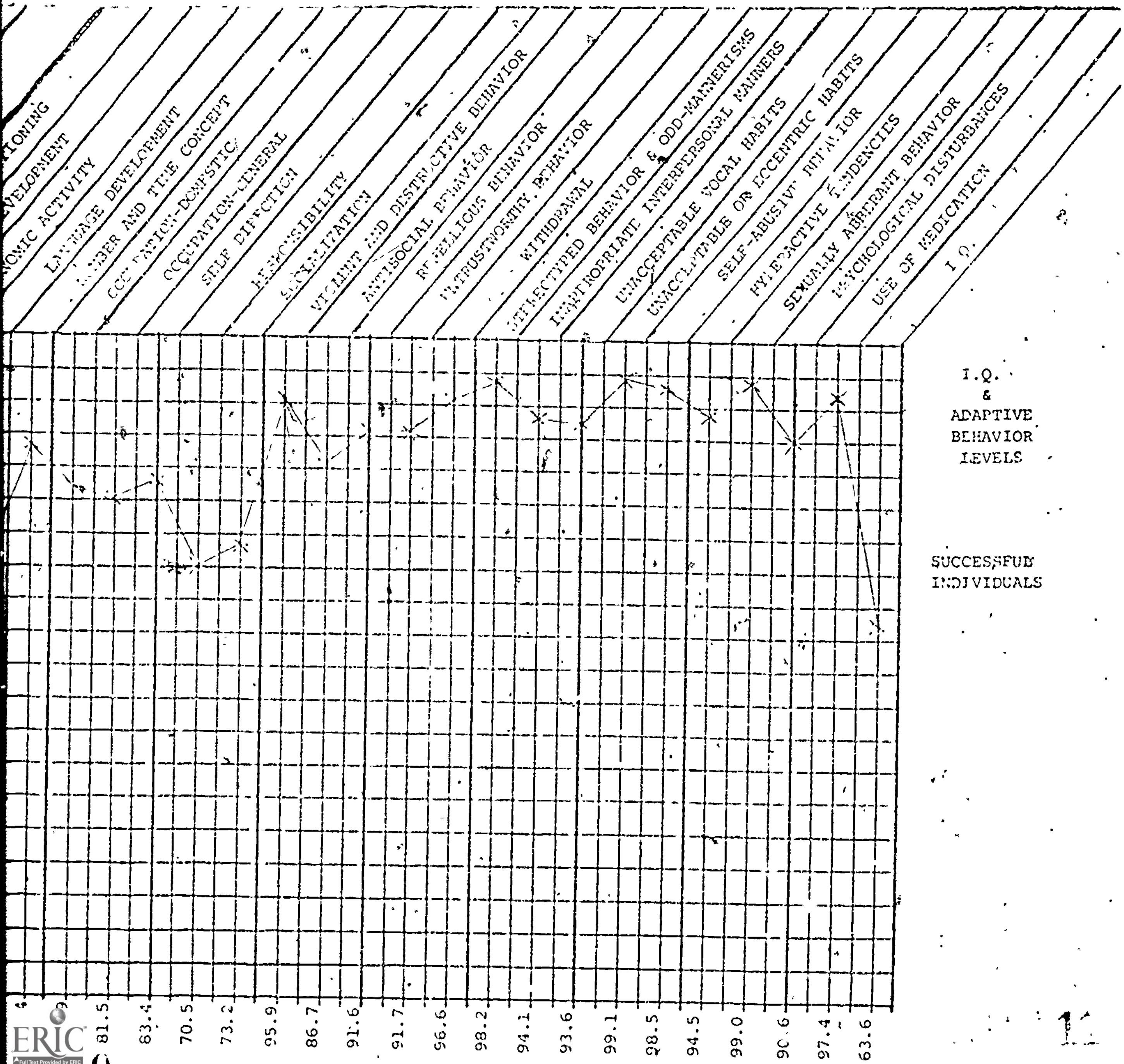
Table I lists the variables that contribute the most to group discrimination. The "positive direction" indicates that the successful group scored higher, or received a better score, on that particular variable. The "negative direction" indicates that the successful group scored lower on that variable. The successful group scored at a lower percentile level in the area of language development than did the non-successful group. In the area of untrustworthy behavior, the second most heavily weighted discriminate function coefficient, the unsuccessful group was found to be more untrustworthy because they fell at a lower percentile level than the successful group. Inappropriate inter-

FIGURE I


PERCENTILE
PHYSICAL DEVELOPMENT
OCCUPATION-GENERAL
SELF DIRECTION
SOCIALIZATION
VIOLENT AND DESTRUCTIVE BEHAVIOR
ANTISOCIAL BEHAVIOR
UNTRUSTWORTHY BEHAVIOR
WITHDRAWAL
STEREOTYPED BEHAVIOR & ODD-MANNERISMS
INAPPROPRIATE INTERPERSONAL MANNERS
UNACCEPTABLE VOCAL HABITS
100
90
80
70
60
50
40
30
20
10
91.7
95.3
81.1
70.2
87.4
83.9
81.5
83.4
70.5
73.2
95.9
86.7
91.6
91.7
96.6
98.2
94.1
93.6
99.1
98.5
94.5
99.0
90.6
97.4

-8-

FIGURE I



TIONING
VELOPMENT
NOMIC ACTIVITY
LANGUAGE DEVELOPMENT
NUMBER AND TIME CONCEPT
OCCUPATION-DOMESTIC
OCCUPATION-GENERAL
SELF DIRECTION
RESPONSIBILITY
SOCIALIZATION
VIOLENT AND DESTRUCTIVE BEHAVIOR
ANTISOCIAL BEHAVIOR
REBELLIOUS BEHAVIOR
UNTRUSTWORTHY BEHAVIOR
WITHDRAWAL
STEREOTYPED BEHAVIOR & ODD-MANNERISMS
INAPPROPRIATE INTERPERSONAL MANNERS
UNACCEPTABLE VOCAL HABITS
UNACCEPTABLE OR ECCENTRIC HABITS
SELF-ABUSIVE BEHAVIOR
HYPERACTIVE TENDENCIES
SEXUALLY ABERRANT BEHAVIOR
PSYCHOLOGICAL DISTURBANCES
USE OF MEDICATION
I.Q.
I.Q. & ADAPTIVE BEHAVIOR LEVELS
SUCCESSFUL INDIVIDUALS
81.5
83.4
70.5
73.2
95.9
86.7
91.6
91.7
96.6
98.2
94.1
93.6
99.1
98.5
94.5
99.0
90.6
97.4
63.6

FIGURE I (Cont.)

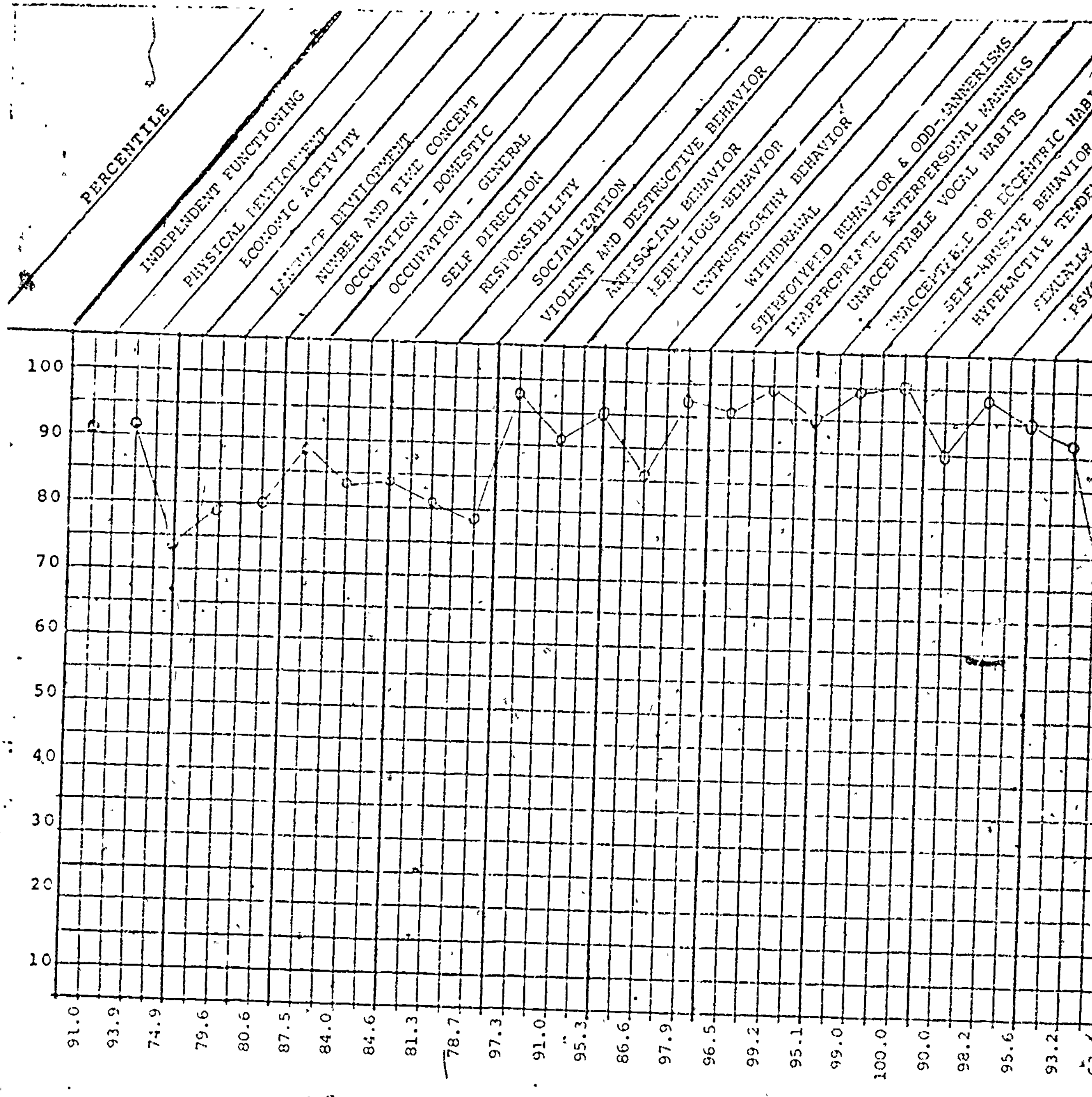


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FIGURE I (Cont.)

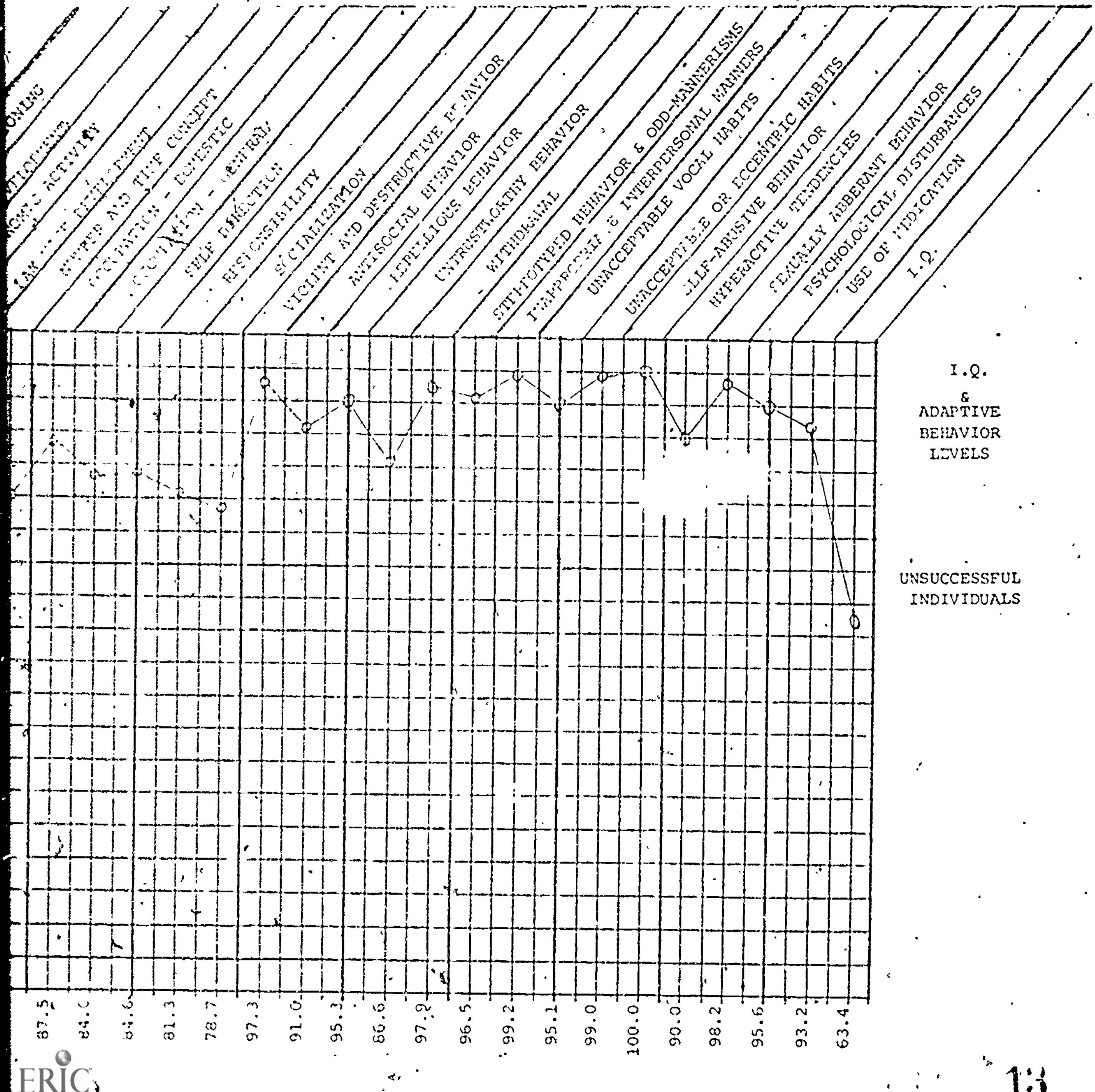

TABLE I

Standardized Discriminant Function Coefficients

Variable	Weight
Language Development	-1.081
Untrustworthy Behavior	.965
Inappropriate Interpersonal Manners	- .705
Economic Activity	.633
Psychological Disturbances	- .571
Number and Time Concept	.554
Rebellious Behavior	- .537
Hyperactive Tendencies	.529
Stereotyped Behavior and Odd Mannerisms	.468
Responsibility	- .462
Self Abusive Behavior	- .444
Independent Functioning	- .407
Occupation - Domestic	.400
Violent and Destructive Behavior	.396
Unacceptable or Eccentric Habits	.388
Antisocial Behavior	.333
Socialization	.320
Physical Development	.269
Unacceptable Vocal Habits	- .255
Withdrawal	- .191
Self Direction	.134
Use of Medication	.130
I.Q.	.124
Sexually Abberant Behavior	- .087
Occupation - General	.002

TABLE II

Evaluation of Classification Functions for Each Case

Function	1	2	Largest Probability	Group Assignment
Group 1 (Successful Group)				
Case				
1	.73758	.26242	.73758	1
2	.92166	.07834	.92166	1
3	.59884	.40116	.59884	1
4	.99225	.00775	.99225	1
5	.81604	.18396	.81604	1
6	.98872	.01128	.98872	1
7	.98708	.01292	.98708	1
8	.70284	.29716	.70284	1
9	.86033	.13967	.86033	1
10	.98666	.01334	.98666	1
11	.61656	.38344	.61656	1
12	.98747	.01253	.98747	1
13	.92434	.07566	.92434	1
14	.95614	.04386	.95614	1
15	.99772	.00228	.99772	1
16	.98893	.01107	.98893	1
17	.99437	.00563	.99437	1
18	.96504	.03496	.96504	1
19	.99188	.00812	.99188	1
20	.93187	.06813	.93187	1
21	.93508	.06492	.93508	1
22	.99257	.00743	.99257	1
23	.19494	.80506	.80506	2
24	.99704	.00296	.99704	1
25	.82203	.17797	.82203	1
26	.96617	.03383	.96617	1
27	.44619	.55381	.55381	2
28	.99861	.00139	.99861	1
29	.90998	.09002	.90998	1
30	.99951	.00049	.99951	1
31	.80973	.19027	.80973	1
32	.99871	.00129	.99871	1
33	.84357	.15643	.84357	1
34	.19911	.80089	.80089	2
35	.74342	.25658	.74342	1
36	.99850	.00150	.99850	1
37	.96188	.03812	.96188	1
38	.69280	.30720	.69280	1
39	.94515	.05485	.94515	1
40	.99075	.00925	.99075	1
41	.63943	.36057	.63943	1
42	.99998	.00002	.99998	1
43	.96008	.03992	.96008	1
44	.99931	.00069	.99931	1
45	.91651	.08349	.91651	1
46	.98866	.01134	.98866	1
47	.99579	.00421	.99579	1

personal manners, weighted at -.705, places the successful group at a lower percentile level than the unsuccessful group.

The discriminant analysis yielded the group classification as shown in Table II. This table is a very useful table in classifying individuals as a member of the successful or nonsuccessful group. The discriminant analysis classifies the individual on the basis of his similarity with members of the group.

For case number one the individual has almost 74 percent probability of being in the successful group and 26 percent possibility of being in the unsuccessful group. The individual was assigned to the successful group which was a correct placement for this case. The number two case again was assigned to the successful group which, again, was a correct placement. Only three classifications were missed in the successful group (Group I) and five were missed in the successful group (Group 2).

Table III shows the classification matrix which summarizes the number of hits and misses for all cases. Out of 72 cases only eight were missed yielding a prediction percentage of 88.8.

TABLE III

Classification Matrix

Function	1	2	Total
Group 1 - Successful	44	3	47
Group 2 - Unsuccessful	5	20	25

The individual percentile levels of adaptive behavior for each were computed and used as the basis for the analysis. Table IV shows the results of successful and unsuccessful individuals. The 24 major domains of adaptive behavior are given in capital letters and the sub-domains in lower case letters.

TABLE IV

Adaptive Behavior
Individual Computer Percentile Levels

Domain and Subdomain	Percentile	
Part I	Unsuccessful	Successful
Eating Skills	86	100
Toilet Use	90	99
Cleanliness	96	96
Appearance	85	99
Care of Clothing	50	100
Dress and Undress	100	100
Locomotion	63	100
General Independent Functioning	63	98
INDEPENDENT FUNCTIONING	85	99
Sensory Development	100	100
Motor Development	95	100
PHYSICAL DEVELOPMENT	95	99
Money and Budgeting	60	100
Shopping Skills	66	99
ECONOMIC ACTIVITY	64	100
Speaking and Writing	86	73
Comprehension	44	99
General Language Development	81	81
LANGUAGE DEVELOPMENT	76	80
NUMBER AND TIME CONCEPT	70	98
Cleaning	[illegible]	100
Kitchen Duties	100	100
General Occupation Domestic	100	100
OCCUPATION - DOMESTIC	95	100
OCCUPATION GENERAL	85	92

TABLE [illegible] (Cont.)

Domain and Subdomain	Percentile	
	Unsuccessful	Successful
Sluggishness	100	100
Initiative	99	99
Persistance	90	100
Planning and Organization	75	100
Self Direction General	33	100
SELF DIRECTION	84	100
RESPONSIBILITY	83	100
SOCIALIZATION	75	[illegible]
Part II		
VIOLENT DESTRUCTIVE BEHAVIOR	100	100
ANTISOCIAL BEHAVIOR	93	100
REBELLIOUS BEHAVIOR	88	100
UNTRUSTWORTHY BEHAVIOR	59	100
WITHDRAWAL	100	100
STEREOTYPED BEHAVIOR AND ODD MANNERISMS	100	100
INAPPROPRIATE INTERPERSONAL MANNERS	100	100
UNACCEPTABLE VOCAL HABITS	94	100
UNACCEPTABLE OR ECCENTRIC HABITS	100	100
SELF ABUSIVE BEHAVIOR	100	100
HYPERACTIVE TENDENCIES	70	100
SEXUALLY ABBERANT BEHAVIOR	95	100
PSYCHOLOGICAL DISTURBANCE	94	99
USE OF MEDICATION	80	100

SUMMARY

This study was addressed to those dimensions of adaptive behavior and intelligence level that might differentiate retarded individuals successfully placed in group living situations from those placed unsuccessfully. The question to be answered was: would a significant difference exist between the two groups and, if so, wherein were these differences? The first part of the question raised in the study was stated in a null hypothesis form and was tested for significance (.05) using a chi-square analysis. Multiple discriminant function analysis was employed to find out which variables contributed the most in distinguishing between the two groups of retarded individuals and to which group, successful or nonsuccessful, an individual would be assigned.

The null hypothesis was rejected, thus indicating that there was a significant difference between the two groups. The specific differences in the behavior domains were weighted and listed. A hit-miss classification table indicated proper assignment of individuals to the appropriate group in 88.8 percent of the cases.

The 72 subjects chosen to participate in this study had all been living, or had recently lived, in a group living home. Those who were unsuccessful had returned to the particular Sunland Training Center where they had lived previously. The subjects' intelligence levels were measured by an individual intelligence test. Their adaptive behaviors were measured by the AAMD Adaptive Behavior Scale.

Discussion

The results of this study should be interpreted within the framework of this study. They would seem valid for the sample but until a cross-validation study takes place, caution must be taken in generalizing the results to larger populations.

It seems unlikely that a higher level of language development would contribute to the failure of a retarded individual to adjustment in a group living home. A closer look needs to be taken in the rater-evaluation system in this area. It would seem possible that the institutional raters might have unintentionally been comparing the unsuccessful individuals with less able individuals in the institution instead of a highly objective individual basis. Also, the institutional rating personnel, in most cases, had known the successful individual longer. As a result, the institutional rating personnel might have been able to experience a higher level of communication with the nonsuccessful individuals than the group living home rating personnel had experienced with the successful individuals.

Adaptive behavior domains that tended to create many problems in group living homes, resulting in the return of the individual to the institution, were the domains of (1) untrustworthy behavior, (2) economic activity, (3) number and time concept, and (4) hyperactive tendencies. Behavioral domains that were tolerated, even though it would seem that they would cause problems, were in the areas of (1) inappropriate interpersonal manners, (2) psychological disturbances, and (3) rebellious behaviors. It seems that this could possibly be when one considers that these areas are often considered tolerable by normal individuals in our society during the adjustment of an individual to a new situation. However, the domains of untrustworthy behavior, economic activity, number and time concept, and hyperactive tendencies might well be intolerable at this time in a group living environment and also in competitive employment.

The hit-miss classification could be one of the most valuable implications of this study. When placing an individual from an institution into the community one must be as certain as possible that an individual is ready for this type of placement. Utilizing this table would have made it possible to hold back on only three of the 47 successful individuals ready for group living home placement, and further would have avoided the return of 20 of the 25 individuals who were not yet ready for this type of placement. Overall one would have been able to have an 88.8 percent accuracy in placement.

Recommendations

There is a need for an intensive effort toward the development of a well planned program of research and training that would contribute to the development of these areas of adaptive behavior in order that the maximum potential of the mentally retarded can be attained. The challenge for finding accurate methods of predicting the adaptation of the retarded individual to the community must be met. The effects of continued failure can be debilitating (Tymchuk, 1972) and children who experience failure withdraw from most all new situations. Once they have failed in this new situation of community living, following a period of institutionalization, they may withdraw to the confines of the institutional walls and never permit themselves to be placed in the community again.

Individual attitudes and personalities of house parents in the group living homes might yield important information regarding the type and level of individual that should be placed in that particular home. By determining the individual expectation levels of each group living home, one would further enhance the possibilities of success for the individual.

Group living homes could be developed to accept individuals falling within certain percentile ranges in order that more homogeneous grouping could be attained. This would enable the group living home to plan programs that would meet the needs of each individual more accurately because of this more precise grouping.

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ABSTRACT

Described are basic electronic features and results of research on the Video Articulator, an electrovisual speech analyzing device which has been used in speech training for the hearing impaired. Data are presented from studies of the validity and reliability of video patterns produced by various speakers using the Video Articulator and by the same speaker using two articulators. Results of several investigations which indicated that hearing impaired persons are able to identify video patterns using the device are reported. A target program using the Video Articulator for shaping and refining speech is explained briefly, and sensory contributions of the device (such as in enabling a child to see sounds he cannot hear) are pointed out. (LS)

ACCEPTANCE OF THE VIDEO ARTICULATOR

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INTRODUCTION

During the past three years an electro-visual speech analyzing device called the Video Articulator has become available to clinicians and educators of hearing impaired individuals. Developed in northern Utah, this device is marketed by Amera Incorporated* of Logan, at about the price of many hearing aids. The Video Articulator is a modified solid-state black and-white Sony television chassis. The set is approximately 7" by 7" by 10" in dimensions, weighs 9 lbs, and is portable

Acceptance of the Video Articulator for the speech training of the hearing impaired may be related to four questions:

1. What are the basic electronic features?
2. Are the video patterns valid and reliable?
3. Can video patterns be identified from one another?
4. Does the video display contribute to the precision with which a hearing impaired person speaks?

The purpose of this booklet is to answer these questions to the extent that information is currently available. It is anticipated that these answers will both stimulate interest in the device and lead to further study and clarification. The data, hypotheses, and remedial guidelines of this progress report may add to the state of the art in speech training for deaf and hard of hearing individuals. Currently, a dozen of these units are being used in speech remedial programs throughout the United States. Upon request, the engineers, Woffinden and Chadwick, will build additional units, distribute, and maintain them.

In the past electro-visual speech analyzing devices have not been widely accepted within the communicative disorders professions, particularly among teachers of the hearing impaired. Two main reasons for this lack of acceptance seem to be (1) adequate rationale for their use has not been advanced, and (2) clinicians and teachers are not trained to use these devices. It is expected that this presentation will contribute to the willingness of specialists to explore the value of the Video Articulator as an aid to speech remediation.

ELECTRONIC FEATURES

First Main Feature

The Video Articulator is a successor to the Voice Visualizer described by Pronovost et al. (1967). As an electro-visual speech analyzing aid, the Voice Visualizer is a modified cathode ray oscilloscope. It includes a special phase-splitting circuit that presents on the scope face a circle rather than the standard sign wave with a pure tone input. Those who have used the Voice Visualizer note that by saying various consonants and vowels into an attached microphone, a variety of visual patterns appear. It is of interest that the Voice Visualizer was featured in a news article describing many speech analyzing devices demonstrated at an international sensory aids conference held in Washington, D.C., during 1967 (Pickett, 1968). Possibly it was the uniqueness of the oscilloscopic patterns that caught the attention of the reporter.

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The oscilloscopic patterns of the Voice Visualizer have been called "lissajou" displays. Resulting from two signals 90 degrees out of phase, electrical engineers have used such displays as a means of observing frequency ratios and "zero" beats. The "all pass" networks achieve a 90 degree phase difference over a wide range of input frequencies.

In 1968 and 1969 Woffinden and Chadwick, engineers at Utah State University, modified two oscilloscopic systems using the Voice Visualizer special circuit. By 1971 they decided that the phase-splitting circuitry could achieve the same result at less cost in a television set. Since then, they have built special integrated circuits into a dozen televis on sets as a beginning to making such units within easy reach of almost all speech and hearing clinics and school programs.

The term "Video Articulator" has been applied to these devices because of the use of television and focus upon articulation applications. The first Video Articulator units utilized Sears portable television sets weighing about 16 lbs. The modified Sears sets permitted the clinician to switch between use of the devices as television sets or as speech aids. Current utilization of modified Sony sets provides increased pattern visibility as well as greater portability. The television capability has been removed, however, to provide adequate space for the special circuitry.

Second Main Feature

During 1974 Woffinden and Chadwick modified the Sony television sets in a second way. They added an audio oscillator system that now also permits the clinician to identify quantitatively the pitch or fundamental frequency of vocalization. Controls on the front of the unit can vary oscillator frequency from 50 to 500 Hz. Notwithstanding the frequency of the tone, it appears as a circle on the screen. When the client sustains a vowel, it also appears as a circular pattern on the screen. The oscillator pattern and the vowel pattern superimpose, producing a "beating" configuration when they are at the same frequency. Noting this, the clinician can determine this frequency by looking at the calibrated and numbered oscillator dial. A schematic diagram, and a block diagram of both the oscillator and phase splitting circuits may be seen below.

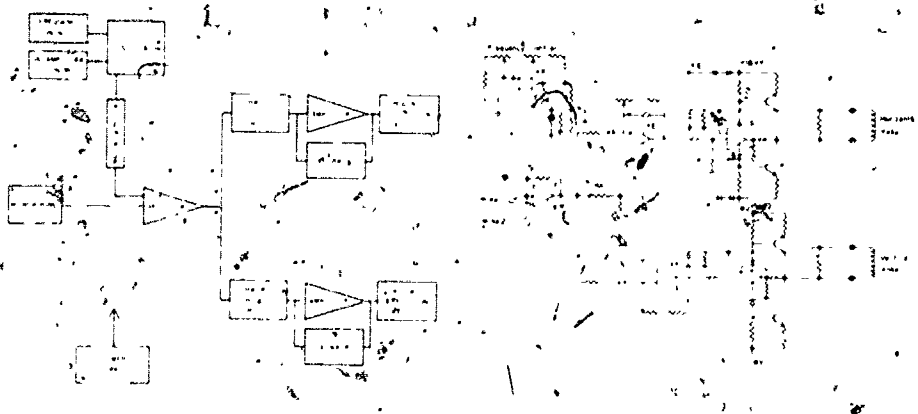

Figure 1. Special circuitry of the Video Articulator.

VALIDITY AND RELIABILITY

Basic Correlates and Video Patterns

Five video configurations are correlates of the basic auditory phenomena of [...]etic or articulatory features of speech. These basic correlates, together with video [confi]gurations for each of 36 consonants, vowels, and diphthongs, may be seen in Figure 2 on the following page:

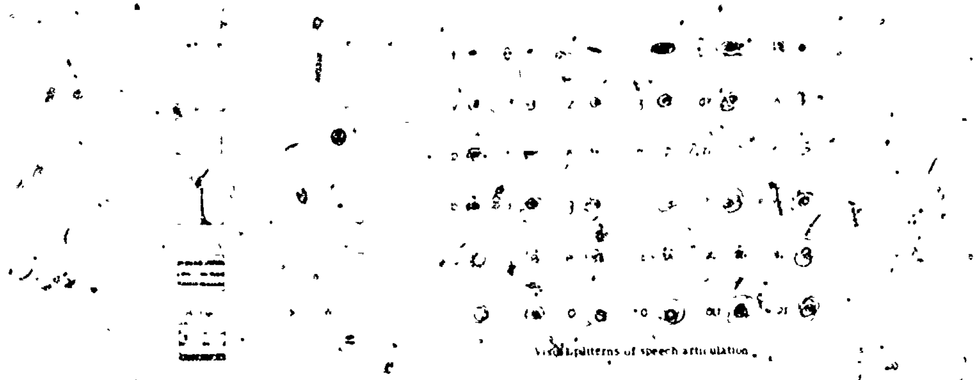

Figure 2. Basic correlates and video patterns for each of 36 English phonemes.

The auditory-visual conversion that occurs when isolated articulations provide microphone input into the Video Articulator may be seen above and to the left. Basically, a pure tone becomes a circle; white noises as /θ/, /f/, /s/, /ʃ/, and /h/ become many circles, bursts as /p/, /t/, /k/, and /tʃ/ appear as splashes; formats that characterize all voiced consonants as well as vowels and diphthongs are seen as loops; and buzzes of the voiced fricatives, namely /v/, /ð/, /z/, and /ʒ/ become whirls or concentrations within loops.

The circles, splashes, loops, and whirls can be identified in each of 36 video patterns grouped at the right in Figure 2. These 36 configurations are drawings of video patterns made by the writer as he articulated corresponding consonants, vowels, and diphthongs into the microphone of one Video Articulator. The similarity of his patterns to those of other speakers, and the similarity of such configurations when comparing two Video Articulator units, will be described later.

Inspection of the 36 video patterns of speech articulation of the writer reveals that variations occur in configuration and in size. For example, the /θ/ pattern is the smallest of all configurations. It can be differentiated from the similar sounding /f/ on the basis of size. On the other hand, the /ɪ/ and /e/ are more similar in size but vary more in configurations. Other visual features also provide clues for pattern identification such as content and angle or tilt. Within the /ɪ/ and /e/ patterns, for example, more inner loops are occurring for the latter front vowel. Another example is the /s/ which appears to be at an oblique angle.

Clinician Models

The video pattern for a particular articulation or phoneme appears to be the same each time that it is produced by a given person, provided:

1. The phoneme is articulated in the same manner.
2. The distance between the lips of the speaker and the microphone is the same.

Many clinicians and teachers need practice before they can precisely articulate various phonemes. They perhaps have more difficulty articulating the fricatives, particularly the voiced ones, than any of the other groups of consonants, vowels, or diphthongs The writer suggests that the Video Articulator be used as a device for determination of meeting criteria in the articulation of English speech sounds. It appears that inadequate clinician models could be a contributor to current speech problems exhibited by certain hearing impaired children.

When clinicians do articulate precisely, however, their video models are more similar than different. Table 1, for example, compares the audibility, lipreadability, and videobility of the writer and five student clinicians in the articulation of 36 isolated phonemes. Articulations were videotaped and played back to four judges who rated them on the following scale. 1 = highly similar, 2 = similar, 3 = partially similar, 4 = dissimilar, and 5 = highly dissimilar.

Table 1. Mean similarity of audibility, lipreadability, and videobility of the writer and each of five female clinicians in the articulation of 36 isolated phonemes.

Comparison	Audibility	Lipreadability	Videobility
1. Writer-Clinician I	1.0	1.1	1.8
2. Writer-Clinician II	1.1	1.3	2.3
3. Writer-Clinician III	1.1	1.0	1.9
4. Writer-Clinician IV	1.2	1.1	1.7
5. Writer-Clinician V	1.1	1.4	2.8
Mean	1.1	1 2	2.1

It may be noted that higher similarities occur between the writer and some clinicians than between the writer and others. Inspection of Table 1 reveals that the sounds and lip positions of the writer and the clinicians were highly similar for the production of the 36 phonemes. It also indicates that the video patterns of the writer and clinicians generally were similar. The judgments were made after the clinician-judge had at least five hours of practice in studying writer-clinician comparative productions on videotape. During practice the judge was also comparing her observations with the three other judges viewing and listening to the same videotape recordings. The correlations between the judge of Table 1 and the three other judges were 1.0, 0.8, and 0.5.

Within the category of videobility comparisons, the articulations of the writer and the clinicians were judged to be highly similar for 29 percent of the phonemes, similar for 42 percent, somewhat similar for 17 percent, dissimilar for 9 percent, and highly dissimilar for 2 percent of the phonemes. It should be mentioned that the videotapes were made before the five clinicians had practiced articulating the phonemes into the microphone of the Video Articulator. During the videotaping the writer passed the microphone between himself and the clinician for each articulation. He controlled distance as well as he could under the circumstances. It may be hypothesized that with practice and control of distance, a higher percentage of highly similar video configurations would have been produced.

Further study needs to be made of similarity of video patterns among clinicians after certain variables have been eliminated or alleviated. Clinicians should have to meet criteria in precision of articulation as a first prerequisite. Secondly, they should be free of laryngeal or nasal problems. During the articulation of /m/, /n/, and /ŋ /, for example, the writer was unable to produce adequate nasal resonance because of upper respiratory congestion. Distance and loudness should also be controlled because size of pattern is a factor influencing judgment of similarity or dissimilarity among clinicians. Similar investigations also need to be made between males and females, and adults and children with various pitch levels.

Experience suggests to the writer that some articulations lend themselves to standard video pattern production more than other articulations. At this time, a scale of normal similarity of video patterns among persons has not been developed. However, it appears that various speakers tend to produce highly similar video patterns for most voiceless phonemes, voiced stops, and diphthongs, and some fricatives, glides, and vowels. Further investigation should clarify this clinical judgment.

The data of the experiment and of clinical experience with the Video Articulator suggests that video dissimilarites (4 and 5 ratings) among normal speaking persons are rare. For example, an adult male with a base voice might not present as suitable video models for a child as a female clinician would. However, he would be able to model articulations for many phonemes. His comparisons with the child should be highly similar for some phonemes, similar for others, and at least partially similar for the remainder.

Unit Models

If a clinician switches to use of a second Video Articulator unit, a question is raised as to the degree of similarity of first-second unit patterns. The engineers suggest that the patterns should be highly similar provided careful matching of frequency, phase, and amplitude characteristics among the two units is conducted. Once adjusted, the inter-unit pattern similarity should remain constant, particularly if high quality electronic parts are used in the special circuitry. Figure 3 includes similarity data for two Video Articulator units being used in clinical speech training being conducted at Utah State University. The writer drew the patterns below as they appeared on the units which were placed adjacent to each other. He held two microphones side-by-side in one hand, and articulated repeatedly until satisfied with the accuracy of the drawings. The articulations drawn are representative of the 36 phoneme productions.

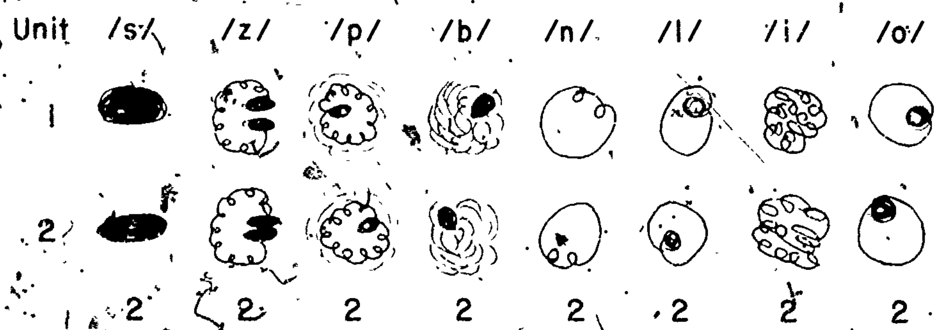

Figure 3. Representative video patterns appearing simultaneously on adjacent Video Articulator units during the articulation of the writer.

In all instances, the writer judged these patterns as being similar to each other or having a rating of 2. Slight differences occurred in horizontal dimension for /s/, amount of whirl for /z/, and rotation of pattern for /p/, /b/, /n/, /l/, /i/, and /o/. Notwithstanding differences, the basic correlates of members of any phoneme are present. For example, the multiple circles occur for /s/ and the whirls for /z/.

VIDEO IDENTIFICATION

Principal Experiment

Preliminary investigation has been made of the performance of the hearing impaired in learning to identify video patterns from one another. Stimuli of these studies have included 36 isolated phonemes primarily but also monosyllabic words. The first subject studied was a 22-year-old deaf male with a corner audiogram. A perceptual learning experiment was designed to compare his performance in identifying 36 isolated phonemes by use of three unisensory and four multisensory conditions. These conditions were auditory (A), facial or lipreading plus taction (B), video (C), AB, AC, BC, and ABC. The writer served as the experimenter or stimulator.

Before the experiment began the writer required the deaf male to perform two skills without error. One was to point to the appropriate International Phonetic Alphabet (IPA) symbol for the phoneme uttered by the writer under an auditory-visual (listening-lipreading) condition. The second skill was that the subject articulate all stimuli under the same condition so that the writer could point to the corresponding symbols without making errors. Practice in responding under all seven conditions was provided also.

During the experiment each stimulus was spoken carefully by the writer and ...itated correctly or incorrectly by the subject. The writer recorded all responses to the ...ft of slash marks, as illustrated in Figure 4 on the following page:

f	ŋ	b	w	h	i
v	o	z	ɛ	k	e
θ	aɪ	ʃ	ʊ	t	ɔɪ
s	n	p	r	g	aʊ
dʒ	m	tʃ	a	ʒ	ɪ
d	u	l	æ	ð	ʌ

Session	Order						
	1st	2nd	3rd	4th	5th	6th	7th
1	A	B	C	AB	AC	BC	ABC
2	ABC	A	B	C	AB	AC	BC
3	BC	ABC	A	B	C	AB	AC
4	AC	BC	ABC	A	B	C	AB
5	AB	AC	BC	ABC	A	B	C
6	C	AB	AC	BC	ABC	A	B
7	B	C	AB	AC	BC	ABC	A

Figure 4. Recording form for one of seven sequences of 36 stimuli together with order of presentation of sensory conditions during each of seven sessions. A single subject followed this procedure.

Check marks were recorded for correct imitations and IPA symbols for incorrect. The experimenter and subject reviewed the response form at the completion of each of 49 tasks. If errors occurred within a task of 36 articulations, the next task was not initiated until errors were identified and discrimination training conducted.

Figure 4 also reveals the design of the experiment. The seven sensory conditions were presented during each of seven learning sessions. The sessions were held weekly and lasted approximately 45 minutes apiece. The sensory conditions were presented in counterbalanced order to offset the serial position effect. The data for each of 49 tasks were the number of incorrect responses out of a possible 36. A total of 1764 responses were made during presentation of each of seven sensory conditions seven times.

All tasks were administered in a clinical therapy room having acoustical treatment and overhead lighting. The distance between the writer and the subject varied from three to five feet, depending upon sensory condition. The staging for each condition is detailed below:

1. **Auditory** (A) – The subject faced away from the experimenter and utilized his personal body-model hearing aid.
2. **Facial** (B) – The subject placed his left hand on the face of the experimenter to perceive tactile speech clues. He also faced and lipread the experimenter.
3. **Video** (C) – The subject watched the screen of the Video Articulator with his hearing aid turned off.
4. **Auditory-Facial** (AB) – The subject listened to, lipread, and touched the face of the experimenter as stimuli were presented.
5. **Auditory-Video** (AC) – The subject looked at the Video Articulator screen and listened with his personal hearing aid.
6. **Facial-Video** (BC) – The subject held his left hand on the face of the experimenter, lipread, and watched the Video Articulator screen.
7. **Auditory-Facial-Video** (ABC) – The subject followed the same procedure as above except that he also used his hearing aid.

By the time the experiment began, the subject was already identifying isolated phonemes by use of the various sensory conditions. Table 2 below presents data emerging from the experiment itself. The raw data on errors per 36 stimuli are converted to percent errors for each session under each sensory condition.

Table 2. Percent errors of a young deaf adult on each of 49 perceptual learning tasks.

Sensory condition	Session							
	1	2	3	4	5	6	7	Mean
A	13.9	5.6	8.3	0.0	5.6	0.0	2.8	5.2
B	0.0	5.6	5.6	5.6	0.0	0.0	0.0	2.7
C	13.9	2.8	2.8	0.0	2.8	0.0	2.8	3.6
AB	2.8	2.8	5.6	0.0	0.0	0.0	0.0	1.6
AC	13.9	5.6	8.3	0.0	0.0	0.0	0.0	4.0
BC	2.8	2.8	0.0	0.0	0.0	0.0	0.0	0.8
ABC	0.0	0.0	5.6	0.0	2.8	0.0	0.0	1.2
Mean	6.6	3.6	5.2	0.8	1.6	0.0	0.4	2.7

The data reveal that the subject identified the great majority of the stimuli under any condition at the onset of the experiment. As perceptual training proceeded, he generally performed even better. For example, during the sixth session, he identified all phonemes under all conditions. It should be noted that the subject hesitated in many instances before responding to certain auditory stimuli. His responses to facial and to video stimuli, however, characteristically were reflexive or without delay.

The separate contributions of lipreading and of taction to speech perception under the facial condition were measured after the experiment was completed. The subject identified all phonemes in lipreading but only 38.9 percent of them using tactile speech clues. The unusually high lipreading scores, reflected in the facial data, reveals that the subject could recognize very subtle differences in articulations. For example, he reported that the labio-dental articulations of the writer shifted slightly in moving from production of /f/ to that for /v/.

The subject also performed remarkably well in auditory and particularly video identification. It may be hypothesized that combinations of durational, intensity, and frequency differences among phonemes within his limited auditory area were enabling him to recognize isolated phonemes by use of residual hearing. Similarly, combinations of one or more of size, configurations, or rotation, together with recognition of circles, splashes, loops, and whirls, may have been the contributors to his perceptual learning of video patterns.

The video patterns identified by this young adult appeared on the screen of an older Sears model of the Video Articulator. It is of interest that he made rapid conversion in identifying configurations on a new Sony unit in later training.

Other Experiments

A follow-up comparison of auditory (A), video (C), and AC identification by 24 young adults has been made by Diamond (1973), a student of the writer. Twelve subjects were normal hearing persons and 12 hearing impaired (47 to 97 dB losses). A representative sample of 10 of the 36 isolated phonemes served as stimuli. These were recorded on audio tape and played back so as to be heard (A), viewed on a Video Articulator unit (C), or heard and viewed (AC). Eight subjects were selected for each of the A, C, and AC conditions of perceptual learning. A 45-50 minute training session occurred for each subject. The results indicated that all of the subjects improved in identification performance as a result of brief training.

In the Diamond experiment, a subject was not permitted to advance from one item to the next until he pointed to the letter corresponding to the stimulus. For example, if unsure of the letter he might point to L, N, T, V, D, Z, CH, I, and L before pointing to S when the stimulus was /s/. This differed from the procedure of the earlier experiment described in which the young male adult moved from item to item without stopping, whether right or wrong. He could tell from the writer's marking each response whether he was right or wrong. At the completion of a given block of 36 items, he was given brief discrimination practice using the items he missed.

Diamond's subjects generally made fewer errors under the A and AV conditions. However, this was expected since their A and AV baselines were much higher. The lag in V performance merely suggests that identification of a new set of signals requires training. The 45-50 minute experimental period did not provide sufficient practice for considerable video identification to occur.

Table 3 below indicates the error per trial ratio among the 10 isolated phonemes for the eight subjects learning under the video condition. By definition a trial is one presentation of a given stimulus or item. It may be noted that a mean of 3.4 errors per trial occurred across all video training. The phoneme presenting the most difficulty was /l/. The error per trial ratio for /l/ was 6.3. Of the eight subjects, however, four identified the /l/ configuration more quickly than the mean identification (3.4 errors/trial, for all phonemes.)

Table 3. Mean errors per trial during video learning of 10 isolated phonemes by eight young college students.

Errors per trial	Isolated phoneme										Mean
	s	z	v	t	d	tʃ	dʒ	n	l	i	
	2.5	3.0	2.0	4.0	3.3	3.7	2.9	3.2	6.3	3.2	3.4

It may be hypothesized that each subject would have identified all 10 phonemes under the video condition if sufficient appropriate practice had been provided. The young adult serving as the subject of the previous experiment, for example, required four 45-minute training sessions, plus preliminary practice, before reaching errorless auditory or video identification of 36 phonemes under A, C, or AC conditions. As shown in Table 2, his lipreading identification throughout the experiment was essentially errorless. The latter data are derived from his responses under A, AB, BC, or ABC conditions (B = lipreading plus taction or lipreading).

In an experiment by another student of the writer, Rouzer (1972) traced progress in articulation of the /s/ phoneme by two hearing impaired children who had intermittent access to video configurations of the target phoneme. With or without video stimulation, Rouzer also prompted /s/ articulation by use of audition, lipreading, and tactile speech clues. Using these multisensory conditions, each subject mastered a Mowrer /s/ program and transferred increasing progress during training to 30-item Shelton probes. In instances in which Video Articulator clues could be observed, one subject attended to them but the other did not. The first subject preferred to rely upon lipreading for model identification. The second was conditioned to use of audition. It may be hypothesized that such preference would generalize to other hearing impaired children who rely upon lipreading clues or upon clues from residual hearing as primary modalities of sensory input. This preliminary finding also suggests that video identification practice might be prerequisite to advantage gained from use of the Video Articulator in speech remediation, particularly for hearing impaired individuals who rely upon lipreading.

Still another student of the writer, Stokes (Berg and Stokes, 1974) has conducted preliminary training in video identification with hearing impaired children. Her procedure has been to divide the 36 stimuli into groups of six each for discrimination practice. Initial data from very limited experimentation with this approach reveals that subjects learn to identify video patterns within these groups. Further investigation is needed to clarify time needed to learn, the extent of perceptual learning which occurs, the specific identification which presents the most difficulty, transfer to larger groups of stimuli, and conditions which facilitate rate of identification.

An interesting phenomena that occurs in perceptual learning of phonemes is concurrent refinement of the articulatory responses of a given client. This was particularly evident during experimental training with the young deaf male adult. Significant articulatory improvements were noticed by the writer including vowel, diphthong, and affricative productions. This suggests that an important component of a speech remediation program for a hearing impaired person is perceptual training in one or more of auditory, lipreading, and video identification.

VIDEO CONTRIBUTION TO SPEECH PRECISION

Target Concept

During 1973-74 the writer incorporated the Video Articulator into a target program for shaping and refining the speech of the hearing impaired. The basic feature of this program is utilization of outer and inner rings and the bullseye of a target to record judged accuracy of speech responses. A given target may be used to record baseline and shaping performance during a speech training program. The specific speech productions being judged may be phonetic, prosodic, or vocal parameters of utterances. These productions may be in isolation, words, phrases, or sentences. The writer's initial use of the target has been confined largely to judgment of accuracy of 36 articulations in isolation, words, and sentences.

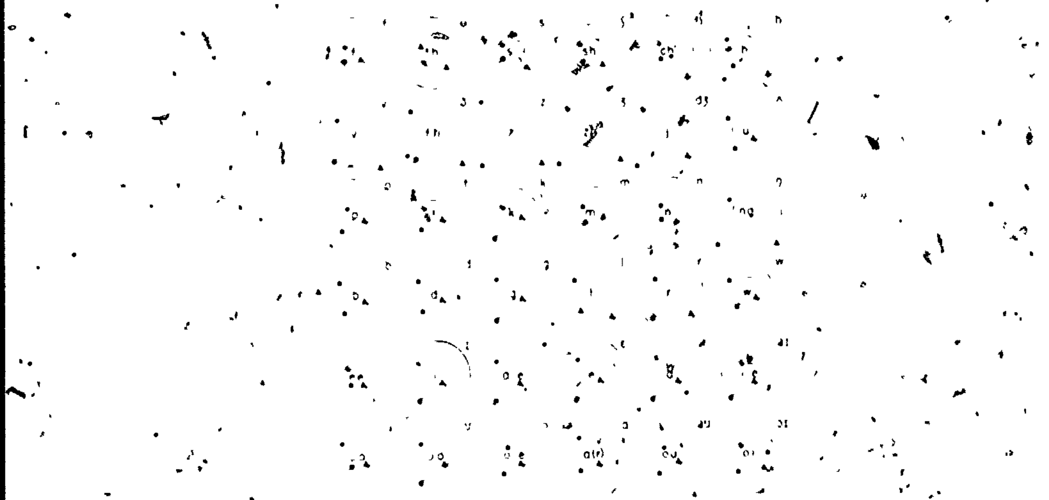

Figure 5. Articulations and misarticulations of three hearing impaired children as noted by bullseye, outer circle, inner circle, and off-target evokings of 36 isolated phones. ● = first child, ■ = second child, ▲ = third child

The targets of Figure 5 above illustrate one application of the use of targets in a speech program. The baseline articulation of each of three hearing impaired children is recorded on 36 targets by use of circles, squares, and triangles. The squares indicate the writer's judgments of articulatory accuracy for one child, the circles for the second, and the triangles for the third. Each target provides space for measures of accuracy for a different one of 36 consonants, vowels and diphthongs. The measures were taken on isolated phoneme production under the combined echoic-graphemic condition. For example, the writer said the /f/ phoneme and a given child looked at him, listened to him, and also viewed the symbol or graphemic form of the stimulus, before imitating or echoing the stimulus. Dependent on judgment of accuracy of response, the writer then placed the appropriate symbol in the appropriate circle. Placement of the symbol outside the target indicated the /f/ was not articulated so as to be recognized as belonging to that phoneme. An outer circle mark shows a gross distortion and an inner circle recording a fine distortion or close approximation. If the mark is placed within the bullseye, the child's response is judged to be an exact or highly similar imitation of the /f/ stimulus.

The responses of a given child or client may also be converted to the numbers 1-4. A "1" indicates bullseye production, a "2" a close approximation to correct production, a "3" a gross distortion of the phoneme, and a "4" production that cannot be identified as falling within the phoneme. An overall score may be computed for each of the three children. Child number one, for example, accumulated 16 "1's," 16 "2's," three "3's," and one "4," totaling 61 points. When divided by 36, the mean accuracy for isolated phoneme production was 1.7 or between bullseye and close approximation.

A variation of this recording procedure might be to use symbols for levels of stimuli rather than for children or clients. Circles could represent phonemes in isolation; squares, phonemes in words; and triangles, phonemes in sentences. Baseline data on a given client would encompass three levels rather than one level of stimulus production. Appendix A includes lists of words and sentences for such an evaluation with a young hearing impaired child. These same materials could be used to assess vocal and particularly prosodic aspects of speech responses. They also provide appropriate stimuli for speech training with young hearing impaired children.

Vocal Tract Phenomena

Figure 6 below identifies the prosodic and phonetic (articulatory) features of speech. Stress and intonation are shown as variations of loudness-duration and pitch respectively. The phonetic features are subdivided into three voicing postures, two oral-nasal or velopharyngeal positions, three levels of restriction or manner of articulation, and three of each of horizontal and vertical localities or places of articulation.

Figure 6. The vocal tract and six associated prosodic and phonetic phenomena.

In a separate article, the writer (Berg, 1972) describes the speech features of Figure 6 in detail. He also hypothesizes the contribution of lipreading, taction, auditory, and video speech clues to the perception of each of these two prosodic and four phonetic vocal tract phenomena. In addition, he suggests that competence in perception of speech clues underpins performance in speech production including phonetic and prosodic accuracy.

Sensory Contributions

The shaping and refining of phonetic and prosodic features of speech by a hearing impaired child often requires structured speech remediation or training. A clinician or teacher assesses child performance, and then designs and implements programming. She devises a program that accounts for conditions antecedent to speech responses and subsequent to them. A main component of antecedent design is consideration of sensory or perceptual modeling that facilitates refinement of speech responses. This sensory model may include one or more of lipreading, auditory, tactile, or video speech clues

Prior to the time that a hearing impaired child can articulate speech sounds, lipreading provides a limited sensory avenue for modeling consonants, vowels, or diphthongs. Only parts of oral restriction and oral locality phenomena are visible to the client. The lipreader cannot perceive stress, intonation, voicing, or oral-nasal features of speech.

Similarly taction provides some oral restriction and oral locality clues. Also, it does not seem to contribute to perception of stress and intonation. However, tactile clues do enable the child to perceive voicing and velopharyngeal postures. By placement of his fingertips and thumb tip on the side of the nose and throat of the clinician respectively, the youngster can tell whether a given phoneme is voiced or voiceless as well as orally or nasally produced.

In speech modeling, audition surpasses lipreading and taction as sensory input for most hearing impaired children. It also often provides more prosodic and phonetic or articulatory speech clues. With many children however, audition does not function at all or is lacking in sensory contribution. Even when combined with lipreading and taction, audition may not provide sufficient sensory speech clues for assisting a child to refine his speech responses.

The Video Articulator enables many hearing impaired children to perceive speech more fully than by use of residual hearing, lipreading, and tactile clues. With training the child learns to identify the video configurations and correlate them to varying extents with stress, intonation, voicing, oral-nasal, oral restriction, and oral locality features. The clinician or teacher can say an isolated phoneme, a word, a phrase, or a sentence into a microphone attached to the Video Articulator unit, and the child can "see" clues of speech. For example, the clinician might articulate a /s/ or a /z/ and circles or whirls within loops appear on the TV screen. For a child with a severe to profound hearing loss, the /s/ might not be heard and the /z/ might be misidentified as a vowel sound. Neither lipreading nor tactile clues could compensate, particularly in the instance of /z/. If the fingertips were placed on the tongue, it would stop vibrating. Also, the /s/ and /z/ cannot be lipread because most of the articulation occurs behind closed teeth.

Video patterns can also be used to demonstrate to the child that particular sounds are occurring which he cannot hear. It should be emphasized that the video patterns are direct correlates of the sounds which produce them. The circles of /s/, for example, occur only when a person articulates /s/ into the microphone. "Seeing" sounds that he otherwise does not sense may motivate the child to try to "hear" them. Thus, the Video Articulator may motivate a hearing impaired child to utilize his residual hearing.

The effect of use of video, auditory, lipreading, and tactile speech clues in an articulatory shaping program can be seen in Figure 7. Baseline and post-training judgments of isolated phoneme articulation by a nine-year-old girl with profound hearing impairment are shown for each of 36 phonemes. Squares and circles on the target reveal the presence and extent of improvement for each consonant, vowel, or diphthong. The mean accuracy of articulation at baseline was 2.8 or nearly gross distortion. The corresponding post-training measure after 10 blocks or presentations of 36 phonemes was 1.2. Preliminary training was given to condition the subject to utilize video clues in addition to other sensory input.

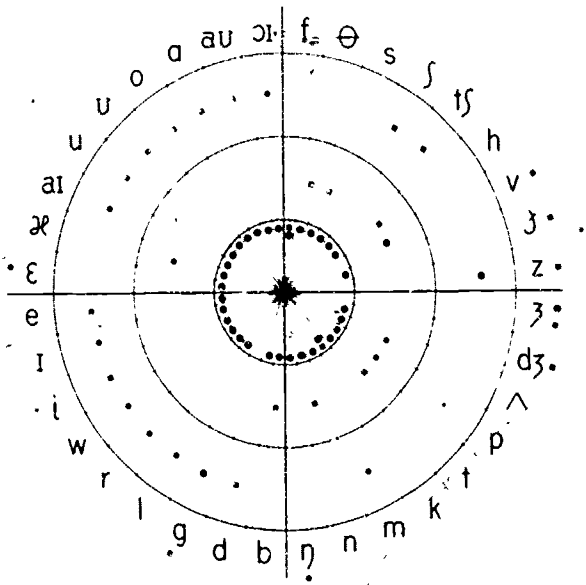

Figure 7. Judgments of accuracy of articulation across 10 blocks of a shaping and refinement program using a nine-year-old child with profound hearing impairment. ■ = baseline, ● = final response

The specific instructions followed by the clinician or experimenter (E) with the subject were:

> E models given misarticulated phoneme for S, using facial-auditory-video condition. S imitates E, and E points on or off target to indicate degree of correctness of response. E also provides token and social reinforcement in accordance with improvements from off target to on target and to inner ring and bullseye. Numerous repetitions of this procedure are presented. Antecedent to each stimulus presentation, E points to the mouth, throat, nose, ear, and screen so as to draw attention of S to a given sensory clues, shifting among lipreading, tactile, auditory, and video pattern from articulation to articulation. All responses of S are recorded and the best effort per articulation given a value of 4, 3, 2, or 1 dependent upon accuracy of production. Both articulated and misarticulated items are practiced to facilitate occurrence of a high correct response rate. Time spent among the misarticulated phonemes is kept equivalent within a given block.

This study and a previous experiment of Rouzer (1972) were designed to assess the contribution of the Video Articulator to progress in articulation training. In both investigations, however, results seem to have been confounded by inadequate experimental design using subjects as their own controls. More carefully designed investigations using experimental and control groups are needed to clarify the specific contributions of the Video Articulator. It may be hypothesized that its main contribution will be in the shaping and refinement of specific speech responses rather than in stabilization and ansfer stages of remedial or developmental programs. Evidence seems to be accumulat-g that the video channel excels other sensory inputs in amount of refined feedback, and at this information is critical to initial habit information.

The Video Articulator has a role in the articulation of sound combinations as well as with isolated consonants and vowels. For example, the child can perceive the video pattern for /s/ in isolated production or in "so," "us," "nice," "listen," or "Mississippi." After the articulations are shaped and incorporated into syllables, words, and sentences, the corresponding video patterns can be observed on the TV screen for presence and accuracy, particularly as utterance is slowed down. Once habit patterns are shaped and established, the auditory-tactile-kinesthetic (ATK) feedback system provides the child with speech monitoring information in the clinic or in every day communicative situations.

Other Video Contributions

Three other Video Articulator applications will be described briefly. One pertains to the evaluation of articulation performance, the second to prosodic training, and the third to identification and modification of pitch level.

In articulation evaluation the use of the Video Articulator as part of the sensory model facilitates the obtaining of a best baseline response. For example, the client can look at the lips of the clinician, listen to her, and watch her production on the Video Articulator screen. Then the client can listen to himself and watch his video configuration as he evokes the imitated response, noting both auditorily and visually whether or not he made an adequate match. Simply speaking into the microphone of the video unit also motivates the child to produce responses that are sufficiently loud for the clinician to hear and evaluate.

The child undergoing prosodic training may also be aided by use of feedback from the Video Articulator. In the instance of many children with profound hearing losses, combined auditory and video clues of stress are invaluable since lipreading and/or taction does not provide them. For example, the child can "see" which syllable of "Mississippi" is being stressed by the clinician or teacher providing the model. He can then note the accuracy of his imitated response. The same children may not be able to perceive intonation patterns by use of auditory or video feedback. In such a circumstance, clinicians might use electro-visual intonation indicators.

The Video Articulator, however, can be utilized to locate and modify the pitch or fundamental frequency of a sustained vowel. The procedure for this has been described earlier under electronic features of the unit. The need for pitch localization and modification is particularly evident in the instance of a profoundly hearing impaired person with abnormally high or low fundamental frequency of vocalization. In addition, the oscillator or pitch capability of the Video Articulator is not limited to one fundamental frequency. The client can be asked to produce several levels that correlate with various pitches used in connected speech, and each of these can be identified. Practice can also be given in repeating these levels when appropriate so they are established within the vocal repertroire of the client. Thereafter, an intonation program can be designed to transfer these pitch patterns into words and sentences of everyday communication.

In summary, acceptance of the Video Articulator as a clinical speech tool for hearing impaired individuals seems to be related to consideration of electronic features, validity and reliability of video configurations, identifiability of the various video patterns, and contribution of video display to speech precision. Considerable rationale and data has been presented to clarify such consideration. It is hoped that this presentation will lead to further studies that contribute to the state of the art of speech remediation or development for this communicatively impaired population.

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APPENDIX

Core Words

1.	f	face, feather, father, friend
2.	th	three, thank, thin, thick
3.	s	song, sack, school, saw
4.	sh	she, shiny, shoe, sick
5.	ch	chair, cheese, child, chip
6.	h	hand, hair, happy, hat
7.	v	visit, voice, very, vacuum
8.	th	those, they, then, that
9.	z	zoo, zigzag, zero, zipper
10.	zh	garage, usual
11.	j	jump, jet, joy, joke
12.	·u·	up, under, above, upon
13.	p	pet, pig, pipe, pink
14.	t	talk, tell, teeth, toy
15.	k	key, keep, kind, king
16.	m	man, many, me, meal
17.	n	name, near, nest, nose
18.	ng	song, long sing, thing
19.	b	back, bag, bad, baby
20.	d	daddy, day, deer, dig
21.	g	grass, green, ground, grow
22.	l	light, long, lunch, laugh
23.	r	rabbit, rain, ran, red
24.	w	wagon, walk, watch, water
25.	ee	eat, easy, each, even
26.	·i·	in, indian, into, it
27.	a-e	aid, aim, ache, acre
28.	·e·	every, enjoy, excite, eskimo
29.	·a·	animal, add, after, and
30.	i-e	ice, ice cream, I, idea
31.	oo	shoe, flew, who, too
32.	oo	look, book, took, shook
33.	o-e	open, obey, old, toe
34.	a(r)	car, star, bar, far
	ou	house, cow, now, brown
	oi	oil, toy, boy, boil

Core Sentences

1.	f	Fine. How are you?
2.	th	Thank you very much.
3.	s	See you later.
4.	sh	Should we go?
5.	ch	Do you like cheese?
6.	h	How are you today?
7.	v	Very good.
8.	th	That is mine.
9.	z	The zoo is fun.
10.	zh	The car is in the garage.
11.	j	Just a minute.
12.	·u·	Go up the stairs.
13.	p	Put the toys away.
14.	t	Time's up.
15.	k	Cut that out (stop that)
16.	m	Move out of the way.
17.	n	Good night.
18.	ng	Good morning.
19.	b	Be careful.
20.	d	Did you forget?
21.	g	Good afternoon.
22.	l	Look out.
23.	r	Are you ready?
24.	w	Wait just a minute.
25.	ee	Do you like candy? Can you see?
26.	·i·	Did you know that?
27.	a-e	Which way should we go?
28.	·e·	When are you going?
29.	·a·	Do you have a cat?
30.	i-e	Hi, how are you?
31.	oo	Who is that?
32.	oo	Look at that.
33.	o-e	Where is the phone?
34.	a(r)	Where is your father?
35.	ou	How did you do that?
36.	oi	Who is that boy?